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The effect of different flicker contrasts on the Dynamic Vessel Analysis

Sascha Klee; Dietmar Link

Author Affiliations & Notes

Sascha Klee
Biomed Eng & Informatics, Technische Universitaet Ilmenau, Ilmenau, Germany

Dietmar Link
Biomed Eng & Informatics, Technische Universitaet Ilmenau, Ilmenau, Germany

Footnotes

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Abstract

Purpose : Retinal arterioles and venules dilate when stimulated with flickering light. This phenomenon is described as functional hyperemia and closely associated with neurovascular coupling. The flicker causes a short period of heightened cellular metabolism which increases the need for blood. As a result the retinal vessels dilate and the blood flow increases. The dynamic vessel analysis (DVA) is a non-invasive method to measure these processes. However, the influence of different flicker contrasts on the vaso-dilation is still unclear. This work aims to clarify whether the DVA is affected by different flicker contrasts.

Methods : The relative vaso-dilation values of 15 volunteers (12m, 3f, 23.2±1.6 years, one eye) were measured using a modified Retinal Vessel Analyzer (Imedos Systems GmbH; standard protocol: duration of 350 seconds). Exclusion criteria were visual acuity less than 0.5, astigmatism >2.0 D, myopia > 5.0 D and ocular and systemic diseases. We investigated two primary vessel segments (superior temporal artery (STa) and vein (STv)) located between 0.5 and 2.0 disc diameters from the optic disc. For each volunteer the DVA was performed six times (rest period: 10min) in a randomized order using different flicker contrasts (c: 0.98, 0.92, 0.85, 0.72, 0.50, 0.20; based on Michelson). To modulate the contrast we used a spatial light modulator (Sony Cooperation;

controlled by a VGA interface) placed in the optically conjugated fundus plane. Contrast values below 0.98 were achieved by controlling with gray values greater than zero (graphics card space 8bit, R=G=B>0). For statistical analysis the t-test and the Wilcoxon test for paired samples were used and Bonferroni corrected.

Results : In all volunteers a reduction of flicker contrasts showed a reduction of the vaso-dilation values for both veins and arteries. Based on the almost ideal contrast (0.98), the following p-values for the differences were obtained: c=0.98-0.92/0.98-0.85 /0.98-0.72/0.98-0.50/0.98-0.20 STa: p=0.999/0.999/0.032/0/0; STv: p=0.807/0.002 /0.001/0/0.

Conclusions : The presented work revealed, that a reduction in flicker contrast leads to less vaso-dilation values. Already at about 70% (for arteries) or 85% (for veins) contrast the vaso-dilation is significantly reduced compared to ideal contrasts (≥98%). In studies with patients who suffer e.q. from clouded lenses this should be considered.

This abstract was presented at the 2019 ARVO Annual Meeting, held in Vancouver, Canada, April 28 - May 2, 2019.